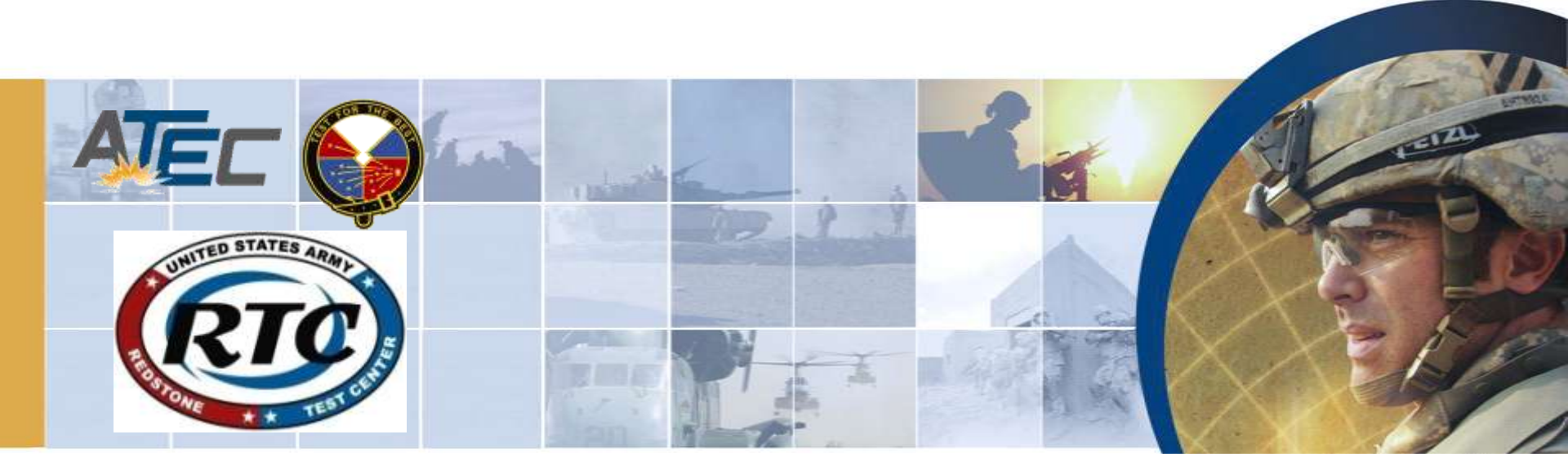

Future Trends and Needs for Distributed T&E Infrastructure

Site Initiatives and Vision

Kenneth G. LeSueur, Ph.D.
Redstone Test Center
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Panel Discussion

"Outline issues, initiatives and vision that sites are engaged with to provide future LVC capabilities"

Three Initiatives are Included in this Brief

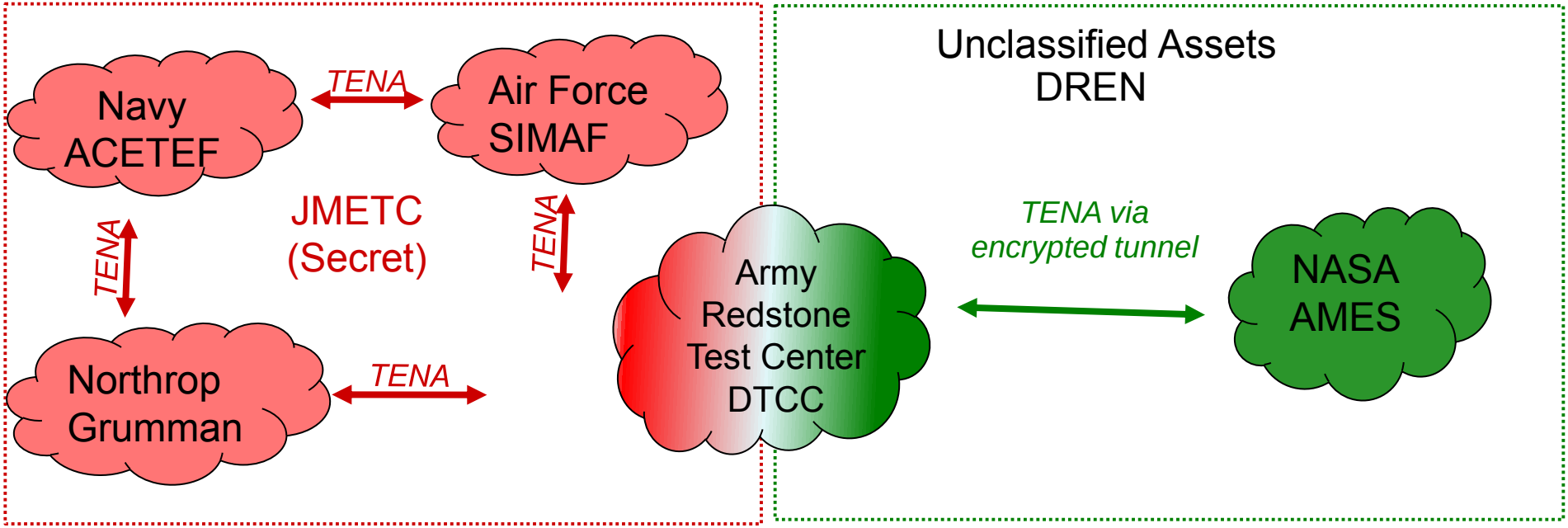
1. Cross Domain Solutions
2. Environmental Effects Servers
3. Emulated Tactical Networks

CROSS DOMAIN SOLUTION NEED

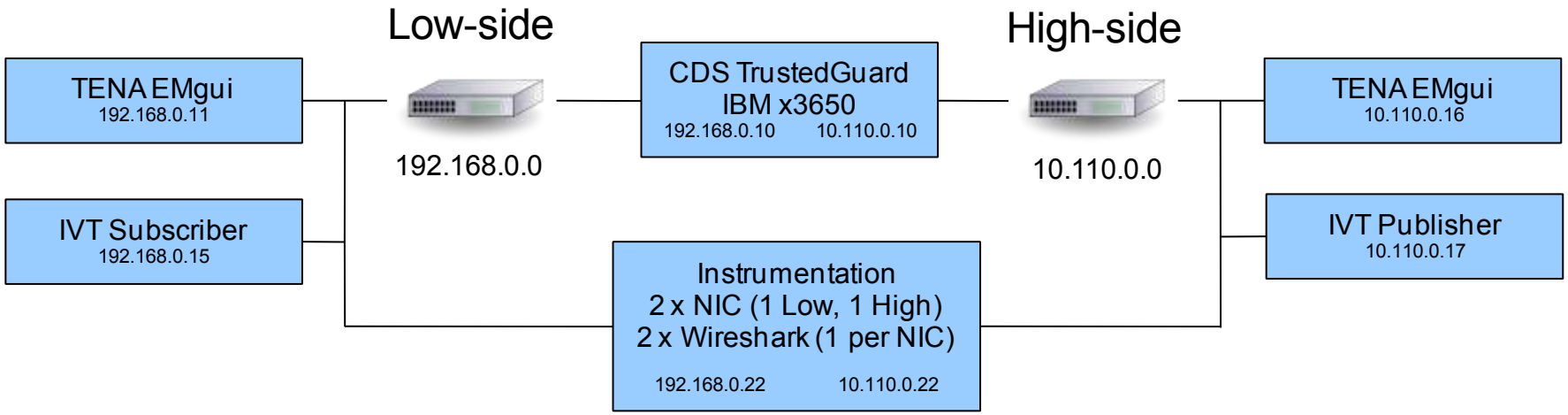
- LVC-DE Cross Domain Solutions (CDS) will allow unclassified test assets to interface with classified networks without the added expense and time of transforming and maintaining the assets as classified operations
- Unclassified data can be passed down from the classified network to the unclassified network allowing for the data reduction and analysis to be conducted and distributed in an unclassified format
- Allow the interface of classified DoD assets to unclassified civilian resources
- The Test & Evaluation community needs both tactical CDSs as well as TENA based CDSs for instrumentation and LVC interfacing

CY 09 UAS in NAS LVC-DE Network Architecture

- The RTC SimShield CDS allows **real-time bi-directional** connection between classified and unclassified test networks passing only approved unclassified **TENA** data between the two networks.
- High-Side LVC assets can only communicate to Low-Side DREN assets through the CDS
- The current CDS ruleset is accredited to pass **TSPI** (Time Space Position Information), **Air Transponder** data, and **TENA Engagement Messages** needed to support the UAS in NAS test event but can be adjusted to accommodate different test missions

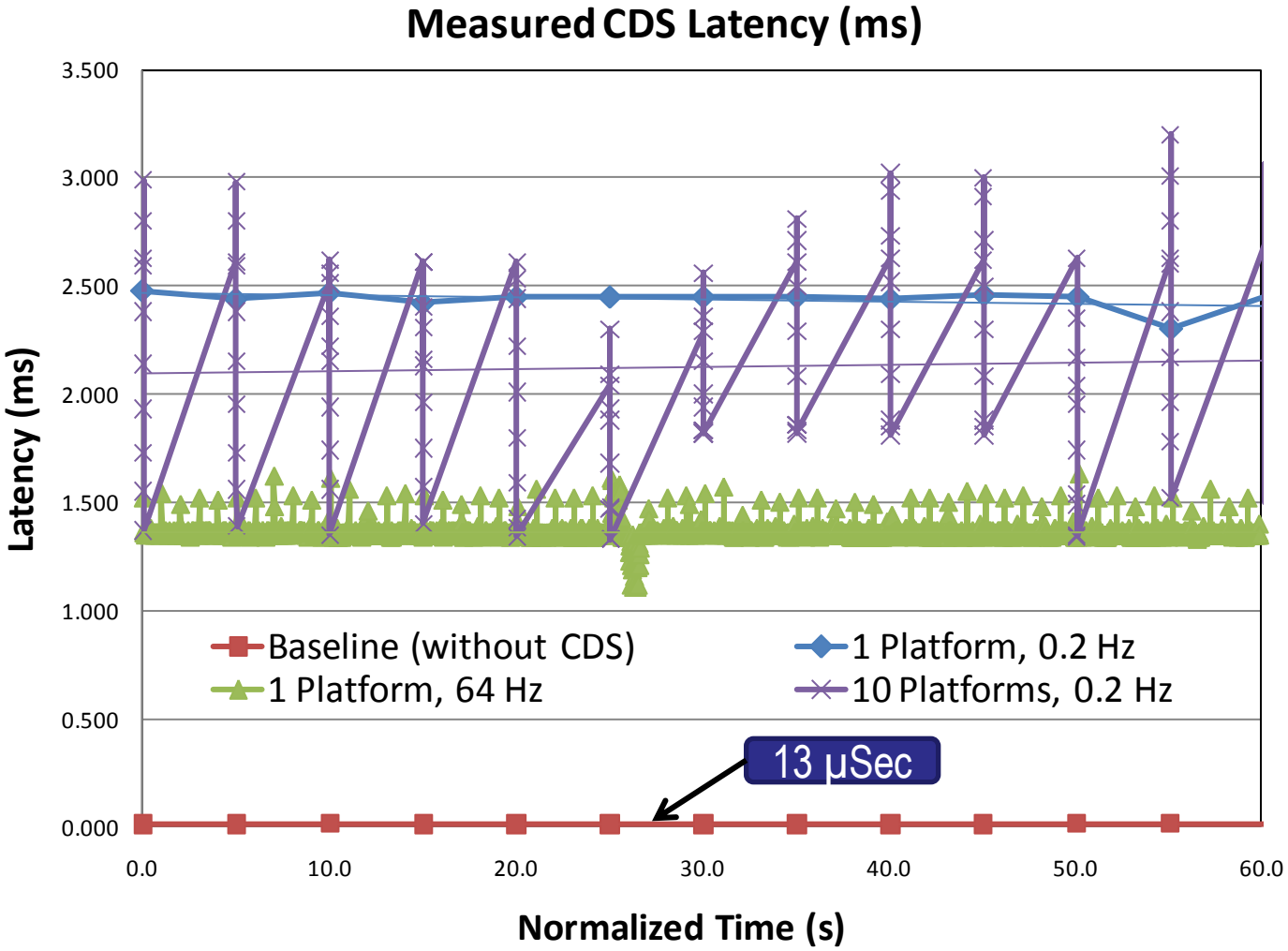


CDS Testbed
Measuring CDS Latency

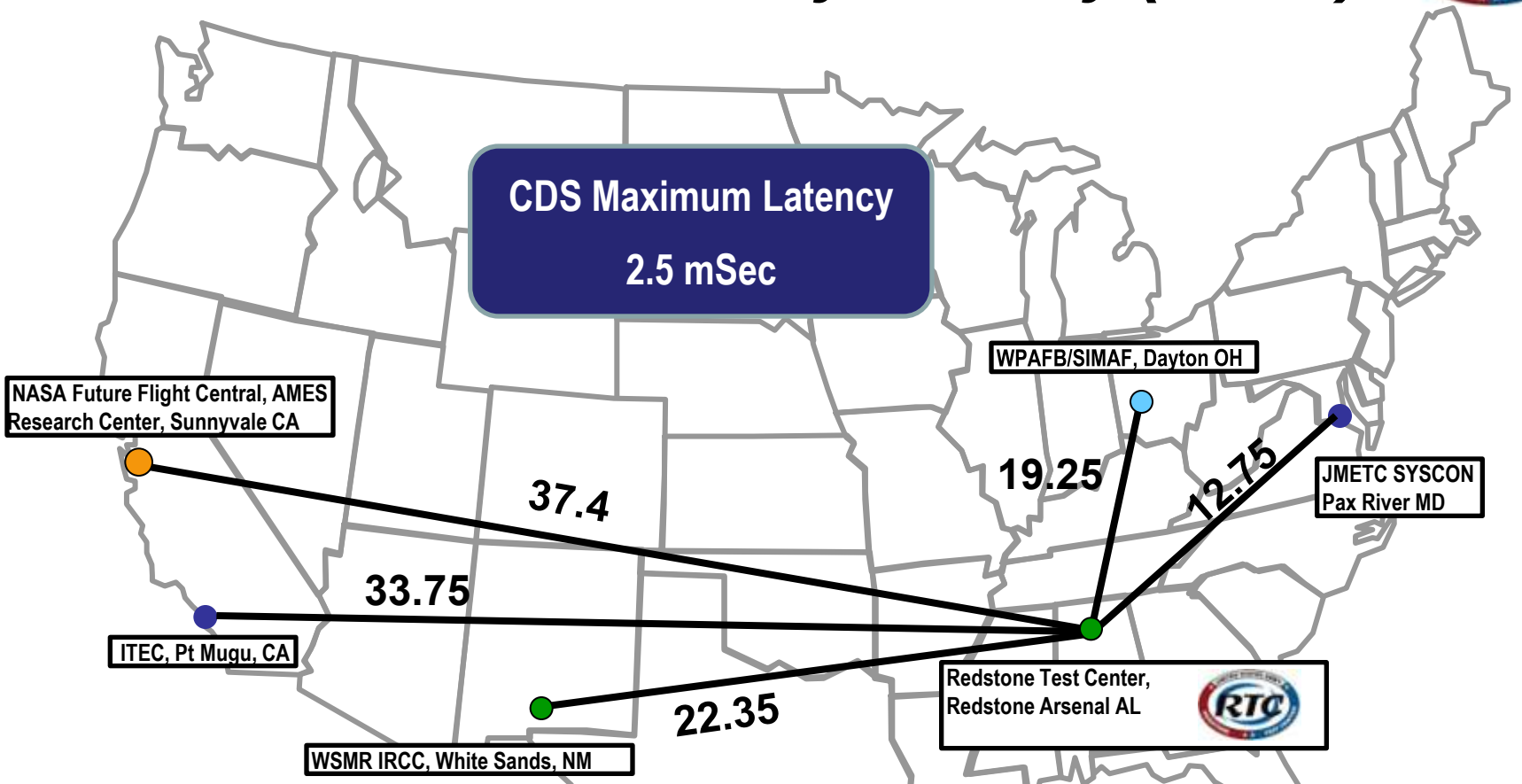


- Two switches, two separate networks
- Instrumentation system with dual NICs, one interface connected to each network
- Two instances of Wireshark, one sniffing packets from Low-side network, one from High-side network
- CDS configured to pass Platform SDOs between High and Low networks

CROSS DOMAIN SOLUTION Performance Data



CROSS DOMAIN SOLUTION
WAN One-Way Latency (mSec)



When conducting distributed testing, the latency through the CDS is much smaller than the Wide Area Network (WAN) latency in most cases.

CROSS DOMAIN SOLUTION Challenges

- TENA Upgrades
  - The CDS Guard is currently certified to use TENA 5.2.2
  - Upgrading the system to TENA 6.0 will require NSA CT&E
  - TENA-TENA Gateways on the High and Low side are necessary to use TENA 6.0

- Approval Schedule
  - Network Architecture or Ruleset Changes requires NSA and CDTAB review and DSAWG approval (Approx. 2-6 Months)
  - The CDS Ruleset must be locked down early in the LVC-DE design process

Terrain Induced Vehicle Vibration Effects Server (TIVVE) Need

- Dynamic testing is required to ensure hardware will survive and successfully perform in their expected dynamic environments
- Increased realism is required during distributed training and test exercises to evaluate the influence of the vibration environment on operator decisions. For example, forcing the operator to adjust maneuvers as needed to achieve its mission objectives
- Subject matter expertise in dynamics testing is required to add validity to the outcome while achieving this capability in a real-time or near-real-time manner

TIVVE Vibration Profiles

- Field Data from Laboratory Vibration Specification (LVS) Development Efforts is used to populate a database for various standard vehicles over eight terrain types and speed profiles listed below

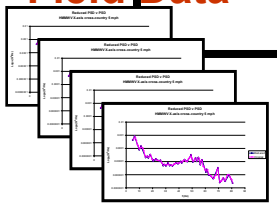
– Cross Country	5-25 mph
– Paved	5-45 mph
– Gravel	5-45 mph
– Belgium Block	5-30 mph
– 2” Washboard	5-15 mph
– 6” Washboard	5-15 mph
– Radial Washboard	5-15 mph
– Embedded Rock	5-15 mph

TIVVE Terrain Mapper

Using operator input, a Terrain mapper application overlays existing terrain with pre-defined terrain that corresponds to one of eight types of terrain categories.

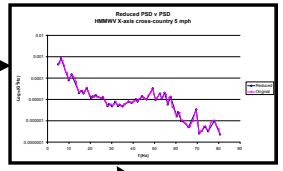
TIVVE Summary

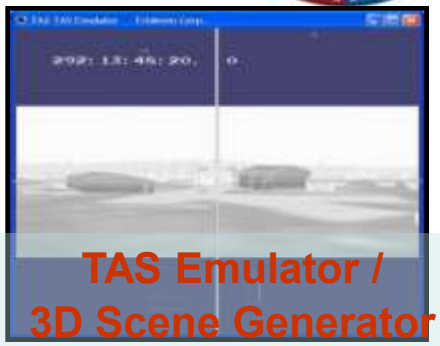
Measured set of Field Data



Vibration Database

Disturbance Vibration Data





TAS Emulator / 3D Scene Generator

TIVVE Server

TENA

Other TENA "Subscriber" Applications

Platform Sim + TIVVE Client

Terrain Mapper

The TIVVE Server distributes representative disturbance vibration data through a TENA enabled architecture to provide realistic environmental effects for elements in a LVC-DE

Terrain Induced Vehicle Vibration Effects Server (TIVVE) Challenges

- To overcome the lack of realistic sensor disturbances generated by maneuvers across the simulated terrain the solution must:
  - Leverage measured environmental effects data effects
  - Overcome bandwidth limitation inherent in distributed environments when dealing with high resolution data to provide effects
  - Provide expandable architecture that can support customer requirements and allow for growth to include other mission profiles or effects

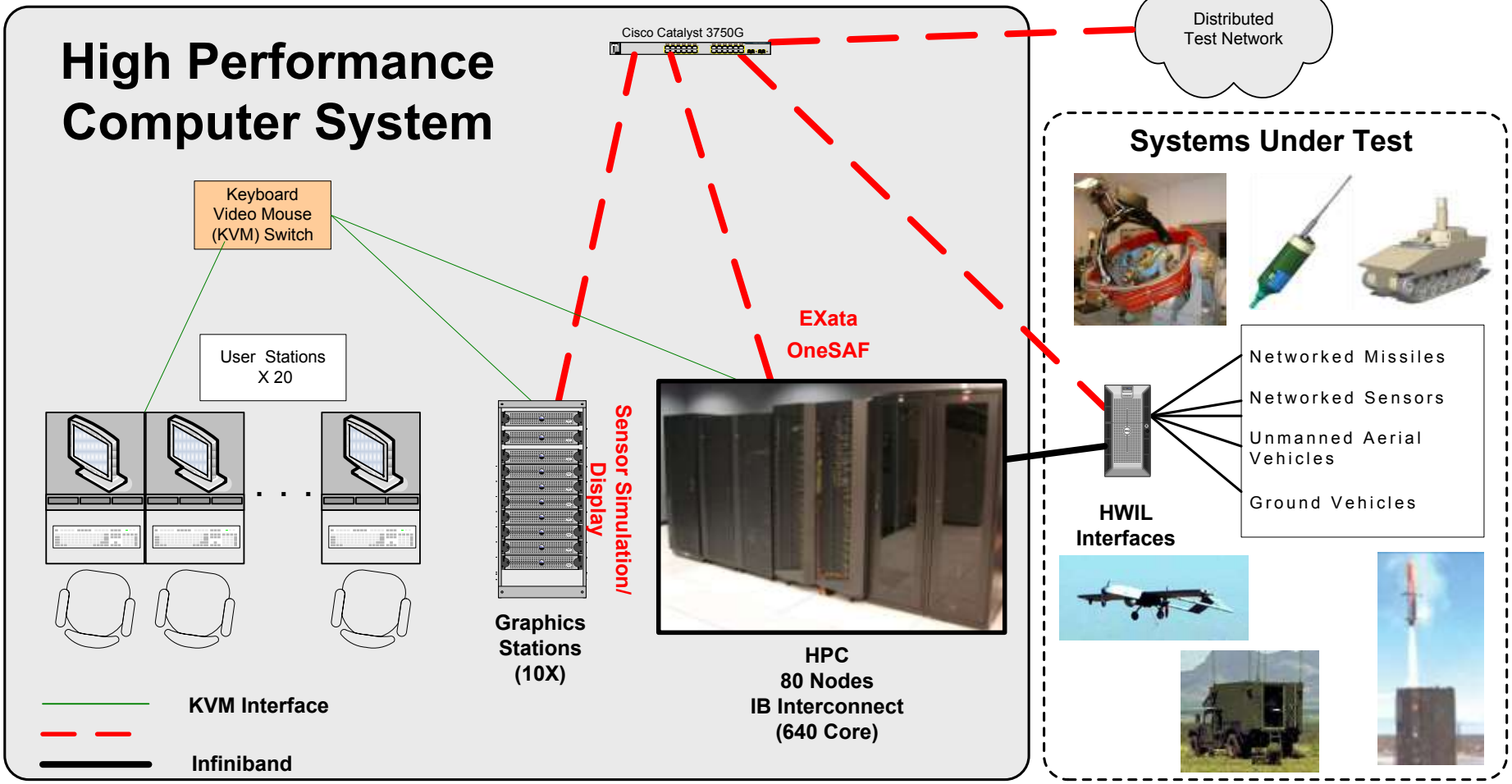
Emulated Tactical Networks NEED

- Wireless Networks are pervasive throughout the battlefield
- Application performance must be tested over realistic wireless networks
- A real-time network emulation with interfaces to real systems
- Real-time core network emulation capability based on validated communications models and engineering/ physics-level propagation models
- Scalable solution to emulate a Brigade size battle

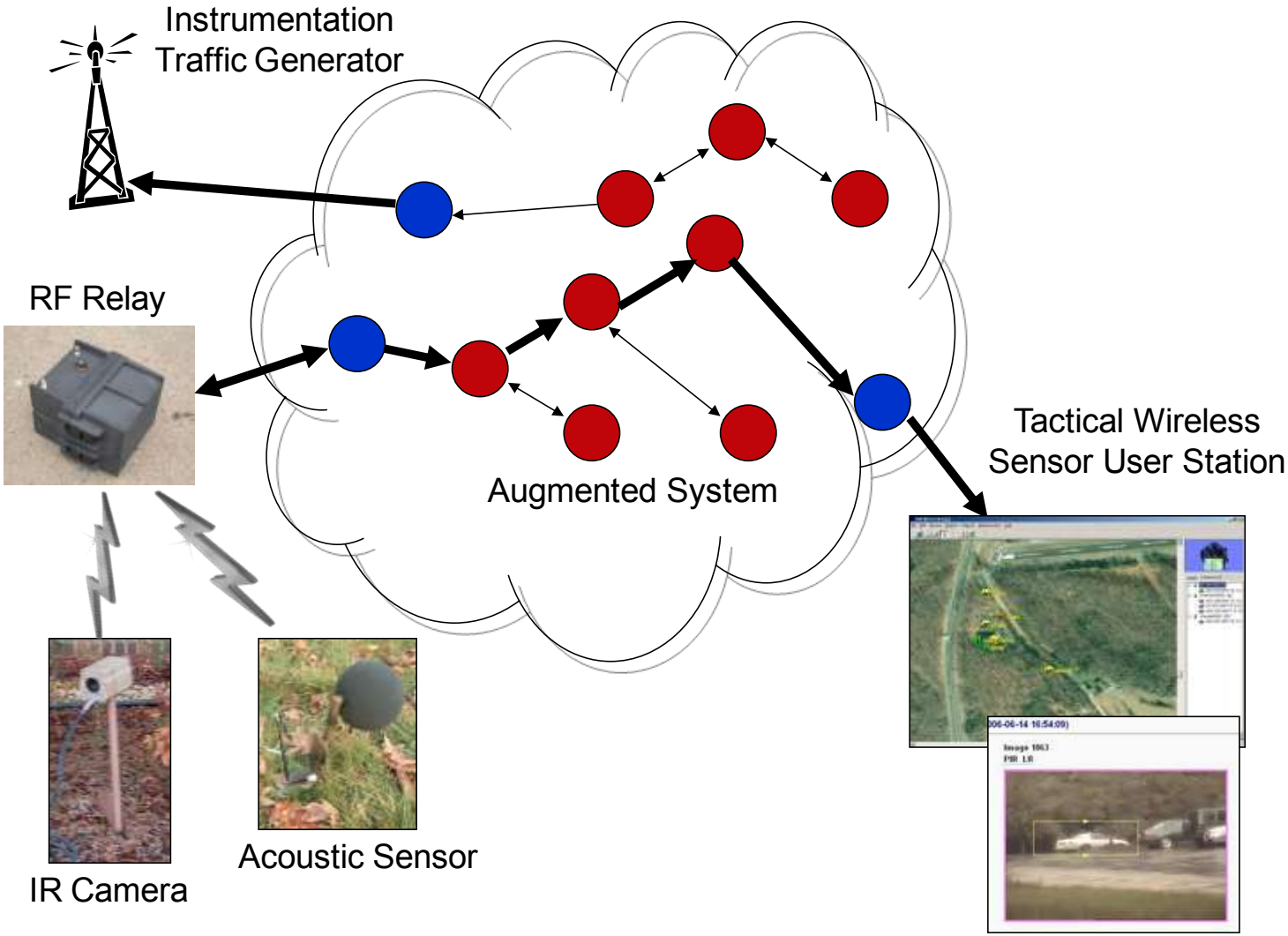
Emulated Tactical Networks Requirements

- Support *hardware interfaces* to actual network nodes
- Provide a *high fidelity simulation* of the wireless network environment
- Provide *scalability* to handle large wireless networks and perform the simulation/ emulation calculations within *hard real-time* constraints
- Interface to *test scenario drivers* such as Computer Generated Forces (CGF) models

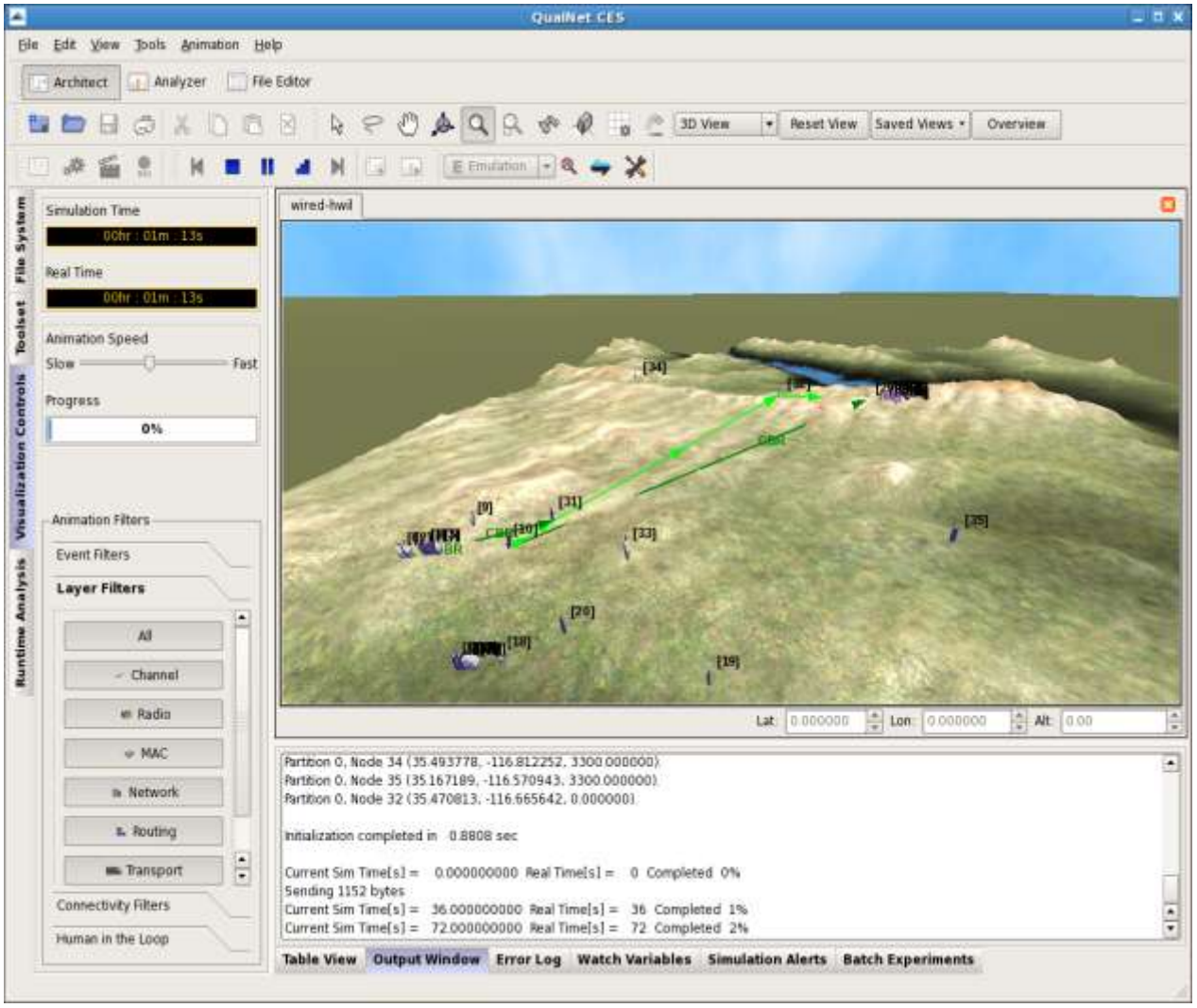
RTC Infrastructure to Support Emulated Tactical Networks



Emulated Tactical Networks Example Scenario



Emulated Tactical Networks



Emulated Tactical Networks Challenges

- Real-Time Operation at Large Scale
- HWIL Interfaces
- Latency with Distributed Operations
- High Resolution Urban Environment Models
- Verification and Validation

SUMMARY

- LVC distributed testing has advanced considerably in the recent years and is proving to be a very beneficial method of testing in certain cases.
- Advancements in the fidelity of tactical network emulations and the use of realistic vibration effects on elements in the environment are enhancing the LVC-DE test methods.
- The use of real-time Cross Domain Solutions are allowing the advantages of distributed LVC testing to be realized by an increasing customer base